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August 26, 1970

FUNDING ENERGY RESEARCH AND DEVELOPMENT

In a number of respects, the production, transmission, and consumption of energy is a significant cause of environmental degradation. Air pollution is caused almost entirely by the combustion of fossil fuels and their use as fuel in electric power plants is the major source of sulphur oxides in the atmosphere. While pollution control standards can require utilities and other industries to utilize existing control technology, the problem is that in many areas adequate control technology does not exist. For that reason pollution abatement is greatly handicapped because implementation of standards would mean that the fuel requirements of our high energy civilization could not be met.

The recent concern for environmental protection has highlighted the need for a stronger R&D effort for all energy sources. There is a particular need for technology to remove sulphur and other pollutants from coal combustion so that our vast coal reserves can be used without variance from air pollution standards. There is also a pressing need for developing supplemental sources of natural gas or its synthetic equivalent as a clean fuel for industry. And we need to develop many promising concepts for more efficient energy systems, including the nuclear breeder reactor, that will provide our requirements with far less fuel.

A wide variety of new ideas have been conceived to meet energy needs and environmental concerns, but the problem is finding the funds to perfect these ideas into usable commercial technology.

The development of any new energy technology into a commercial system requires many years and tens or hundreds of millions of dollars -- occasionally billions. The financial risks and long-term nature of these projects invariably make it impossible for even the largest equipment manufacturers or utilities to undertake the projects on their own. In any event, the benefits, while large to the nation, are often not capturable by the equipment manufacturer. As a result, at present the funding and direction of most new pollution control technology and new methods of power generation must come from the Federal Government or not at all.

When considering the incentives for utility funding of R&D, it must be recognized that the prices the electric power and natural gas companies charge consumers are, to a large extent, fixed by regulatory commissions. The limit placed on their profits removes much of the incentive for R&D. In any event, historically the utilities have spent relatively small sums on R&D. The coal industry, which is still largely made up of small companies also spends little on R&D. Moreover, R&D projects required in the environmental field, offer little or no financial incentives.

The Federal Government has, for a number of years, funded and managed most of the R&D on nuclear power, the largest effort in the civilian energy field. Investments to date for civilian nuclear power R&D is about \$3 billion. By contrast, there has been relatively little R&D on coal or other fossil fuels by government or industry.

Pollution problems and health and safety concerns now require a major R&D effort on the fossil fuels as well as the development of the nuclear breeder reactor -- the major goal of the nuclear program -- which is still billions of dollars away.

There is a consensus among utility executives and government officials that new technology to control pollution of energy production is badly needed and could be perfected but that the funds are simply not forthcoming from either government or industry under the present arrangements.

It is, therefore, apparent that we must look to alternative approaches to funding and managing energy R&D.

Sources of Funds

There are only three possible sources for energy R&D funds in the large quantities necessary -- private investors, the government (i.e., taxpayers), and energy consumers. We have previously discussed some of the problems in encouraging R&D expenditure by investors in the energy companies themselves or their suppliers. These are due primarily to the large sums involved and uncertainties about their being able to capture the benefits. In any event, in the final analysis these sums are paid by the consumers either directly or through the hardware and services sold to the consumers.

The other two sources of funds - taxpayers and consumers - involve the same individuals, but the amounts particular individuals pay and the influences this payment can have on other economic decisions are significant. For example, government funding of R&D has no direct effect on the price paid for energy, but it does affect over-all tax rates. Funding by the energy consumers is reflected in the price paid by the consumers, and this in turn affects energy consumption. The failure to include the bulk of R&D costs in the price of energy may thus result in increasing the use of energy and thereby exacerbating the pollution problem with a resulting misallocation of our Nation's resources. If the bulk of the energy R&D is to be funded from general federal revenues, it must compete for limited funds with unrelated government programs such as health, welfare, education and defense, which may well have higher priority in the eyes of those making the crucial decisions particularly during a tight budget year. This has been our experience to date.

In order to meet the increased needs in light of tight budgets, it appears essential to find new mechanisms for obtaining funds from the consumers directly through the utilities and energy companies selling the energy. In the aggregate their cash flows are enormous. For example, electric sales total more than \$20 billion annually and natural gas sales about \$10 billion. In addition to the policy advantages of reflecting R&D costs in the price of energy, it is important that industry technical expertise be brought into the R&D program. Industry funding will also assist in assuring that priorities are responsive to actual needs.

Several basic policy questions arise from the decision to obtain more funds directly from the consumers/energy companies.

First, can a voluntary system be perfected? As we have previously stated, privately owned electric and gas utilities spend relatively little on R&D both in absolute terms and in comparison with other industries. There is no evidence that any material increase in forthcoming voluntarily. Recent figures show that these firms have been spending on the average only one fourth of one percent of gross revenues directly in support of R&D. They also support some R&D carried on by their suppliers through the prices they pay for equipment; however, the aggregate is still quite low. The R&D expenditures by publicly owned and cooperative electric utilities is probably as low or lower relative to their gross sales. These R&D expenditures do not compare favorably with the United States manufacturing industries generally which invest company funds in R&D equal to about 2% of net sales. Some industries such as chemicals and machinery spend a significantly higher portion of their own funds on R&D.

To develop the needed technology for energy pollution control promptly will require a level of R&D expenditures by the utilities three or four times the existing level. A voluntary approach would require several hundred electric power and natural gas companies to seek rate increases and justify them before the individual state regulatory commissions whose basic mission is to limit rate increases. The thousands of small public power entities would need to be persuaded to follow suit. While the FPC and some state commissions are trying to encourage utility R&D, the uncertainties inherent in the regulatory process, and the large number of utilities and regulating commissions involved places a major hurdle in the path of a voluntary approach.

While it is theoretically possible for the utilities voluntarily to increase research and development expenditures, history, experience, the lack of incentives, and the number of companies and regulatory commissions involved raise grave doubts. We do not believe that a voluntary system for utility support of R&D can be developed on a time scale commensurate with the urgent need and the long lead time inherent in perfecting new technology.

Mandatory Funding Approaches

We feel that a mandatory approach should be taken -- in essence that federal minimum standards be established for support of energy technology development.

Various forms were considered based on total revenues, value added, and profit. From a practical point of view a development fee or assessment based on gross operating revenues would be easiest to understand and administer. In fact, it closely resembles the excise tax currently being imposed on telephone rates. The value added approach would facilitate the participation of firms all levels of the industry but would be much more complex and involves a concept new to the United States. Excess profits or income levies present equally difficult administrative problems and would miss publicly or cooperatively owned utilities.

Several options for administering the funds to be raised were considered. They could be collected by the government as taxes and treated as general revenues. This approach would provide a very weak link between funding and managing the R&D. In fact there is no guarantee that the funds collected would be reflected in the Government's energy R&D budget. Part of the problem could be overcome by designating that the tax funds be used only for energy R&D -- in essence establishing a trust fund. This approach was recently suggested by Mr. Charles Lace, Chairman of the Board of Consolidated Edison. As described in his letter, a copy of which is attached, the

utilities and others would participate through various advisory panels. One problem with this is the lack of flexibility to adjust to changing needs and priorities (e.g., the highway trust fund).

Another alternative which seems to fit this particular problem best is to impose a minimum development fee which utilities would pay to the government; however, they could offset this liability by spending a somewhat larger sum on approved development projects. Under this approach, many of the utilities would be expected to invest directly in technology development rather than pay the tax and since their own funds would be involved, one would expect the projects to benefit by participation of utility technical and management personnel. This industry contribution should serve to ensure that the projects will be meaningful for the utilities which in the final analysis must put them to use. It is, of course, essential to this concept to provide an administrative mechanism to ensure that the national interest is being served by the work actually funded.

Scope of the Proposal

While it might be desirable to develop a system which would cover all of the forms of energy, the most urgent need for additional funding appears to be in those areas that should be of concern to the regulated industries -- electricity and natural gas. The oil industry has a record of carrying out its own R&D. The problems of coal which require R&D (other than health and safety which the Congress recently decided should be Federally funded) are problems of the electric power industry in burning coal to meet pollution standards and of the natural gas industry to convert it to high BTU gas. Uranium would, of course, also be covered by including the electric power industry and its consumers who are the beneficiary of nuclear energy R&D. We, therefore, shall limit the proposal to electric power and natural gas.

To further direct the funds to the most urgent needs and to facilitate the administration it appears best to limit the use of such funds to a relatively few large development and demonstration efforts rather than to include the whole range of R&D. There is no basis for a separate program to support research in the energy field and to do so would create tremendous problems of administration. As discussed previously it is the large expenditures needed to develop existing ideas into commercial useage that are most critical at present. There is no shortage of good ideas for new technologies to alleviate the environmental damage inherent in present energy producing technology but a dire shortage of funds to move the best ideas along

through large-scale demonstrations. Limiting our proposal to large-scale important demonstration projects will enable approvals to be given in advance on the basis of laboratory and pilot scale results rather than on preliminary paper studies. In the longer run, the availability of development and demonstration funds should provide a major incentive for applied research and innovation because the lag between research and outside funding for the innovating firm will be significantly reduced. In essence the fee will support a market for new ideas.

A Specific Proposal for an Energy Development Fee

A. The Basic Concept

In view of the previous considerations, we believe that a minimum development fee of 1% of gross revenues annually should be established for electric power and natural gas firms. This minimum development fee would be collected by the Government but the utilities could deduct from the amount due 75% of any funds it spent in the year on approved development projects. Limiting the offset to 75% of funds spent will provide incentives for the utilities to scrutinize their investments and devote their talents to making the efforts succeed.

To focus this approach on the most critical areas and to eliminate double burden, we would apply the fee to the sales of all natural gas (or its synthetic equivalent) sold by producers, distributors and transmission companies for consumption as energy and to all electric power sold for consumption. Natural gas and electricity sold for resale would be exempt as well as gas sold to electric power companies to generate electricity that would later be subject to the tax. Government agencies selling power such as TVA would have no special exemption.

The amounts were chosen in light of average investments in R&D by the utilities, industry in general and the Federal Government. As noted previously the utilities are presently spending about 0.25% of gross revenues on R&D. While not all of this is on what we would consider approved development projects, a significant fraction is. Based on current revenues, the fee would amount to more than \$300 million annually and would increase by the 5-8% growth rate for these two industries. These sums would be designed to augment the Federal funding for civilian energy R&D of some \$350 million annually. These additional funds are required to pursue the variety of ideas which are currently in need of large scale development and demonstration.

To ensure a timely review of the proposal once it is enacted, its effectiveness should be limited to ten years. This period should be sufficient to establish a suitable track record of accomplishment (or difficulty) and also sufficient to assure continued support for the development projects undertaken.

B. Private and Federal Participation

An important question that must be faced and resolved as part of our energy development fee proposal is who decides what projects are to be funded and who supervises the individual projects?

The energy industries are the ultimate users of new energy supply technology and have the most intimate knowledge of their energy-supply systems. They clearly should be a major participant in the programs. On the other hand, developing technical solutions for many of the environmental problems are of such vital national importance that the Federal Government needs to be assured that they are being adequately pursued.

Since we would anticipate that most of the utilities would choose to put up the additional funds to support the work directly rather than pay the money to the government, it is necessary to ensure that they will spend the funds on projects of environmental or long term national significance. We would propose that the utilities subject to the fee be allowed to use their offset funds only on development projects which have been approved by the government.

As a first step, the Council on Environmental Quality, acting upon the advice of the Office of Science and Technology, other interested Government agencies, and energy industry representatives would publish a list of areas approved for the use of offset funds. The list will not try to identify each project but rather those areas in which we are concerned with the development of new technologies urgently needed to resolve environmental problems and at the same time, increase efficiency and extend our resource base. These areas include:

1. Development and demonstration of control technology for sulfur oxides and other pollutants from combustion of coal and other fossil fuels;
2. Development and demonstration of the nuclear breeder reactor;
3. Development of coal gasification and other means of converting coal to a clean form and supplementing gas supplies;

4. Development of underground high voltage transmission technology;

5. Development of magnetohydrodynamics, combined gas turbine steam cycles and other approaches to improving the performance of fossil fuel plants and minimizing environmental problems.

6. Development of the fuel cell as a source of low pollution energy;

7. Development of better cooling towers and other methods for disposing of waste heat;

8. Development of thermonuclear fusion once the principle has been demonstrated.

While we are also concerned with entirely new energy systems such as solar power and long-term environmental or ecological studies, we feel that these are perhaps more appropriate government responsibilities than the development programs listed.

We envision the list of approved development areas initially to be similar to the one presented above, but that new areas would be added and others deleted as opportunities and needs change.

Each area listed would be under the cognizance of a Federal Agency with R&D responsibility in the field. Individual development projects by industry eligible for the offset could for the most part provide funds in partnership with the Federal Agencies (sulfur oxide control technology at HEW, coal gasification at Interior, breeder reactor at AEC etc.) or new projects in these areas with no Federal funding. But in either event, approval by the Federal Agency would be required in order for the project funding to be eligible for the offset. The project would be reviewed by these agencies to ensure compatibility with the over-all list, government programs and other efforts underway in the area. We would expect that industry-wide R&D organizations such as the Electric Research Counsel, and the Institute of Gas Technology would play a leading role in proposing projects and acting as a central vehicle for joint efforts by the industry.

It is expected that the Federal Agencies would establish specific guidelines for the proposals in each area to ensure among other things than they will be adequately funded over a long enough period with adequate staff to assure that the project will be carried through

commercial demonstration if it is technically and economically warranted. The Federal agencies would be responsible for the initial approval of the project if it is not one in which they are themselves participating and also for reviewing them while they are in progress. The agencies would provide an annual statement of acceptability for offset of each project which together with an audited statement of costs incurred under the project including the utilities share would be accepted by the Government in lieu of the 1% fee due.

We believe that such an approach will provide for the maximum flexibility and initiative on behalf of the utilities while seeing that the government's objectives for environmental and long term energy R&D are met.

Potential Objections

The fundamental objection to this approach is that it is an uncontrollable expenditure of federal funds. Persons taking such a position would conclude that once the federal government decides to legislate such a fee, it in essence becomes a source of tax revenue just like any other tax. Expenditures of such funds should compete with all other federal expenditures, and thus should be included as part of the federal budget. The logical result of such an argument is that the federal government should support only the energy R&D it can justify in comparison with other priorities no matter what the source of the funds. This approach, however, does not meet the need to provide a mechanism to enable the energy consumer to fund energy R&D or the need to mount a more intensive R&D program that cannot be funded by the federal treasury.

We view the minimum fee as a mechanism to correct a basic deficiency in a regulated industry -- underfunding of R&D. Most unregulated industries see the need for R&D to survive and therefore assess their net revenues an average of 2% for R&D. They can see the potential benefits from R&D and have a reasonable chance of capturing them. Since utilities lack the financial incentives for R&D because of that are regulated, new regulations are needed to correct the situation.